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Patentanmeldung Nr. / Patent application No. / Demande de brevet n°

02076288.6

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Im Auftrag

For the President of the European Patent Office

Le Président de l'Office européen des brevets
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R C van Dijk

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Bezeichnung der Erfindung/Title of the invention/Titre de l'invention:
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Optical data storage medium

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Optical data storage medium

The invention relates to an optical data storage medium for recording by means of a focused radiation beam entering the medium through a first plastic/resinous layer transparent for the radiation beam, said medium further comprising at least:

- a first recording stack, comprising a first recording layer, being present proximate the first plastic/resinous layer,
- a second recording stack, comprising a second recording layer, said second recording stack being present at a position more remote from the first plastic/resinous layer than the first recording stack,
- a transparent spacer layer between the first and the second recording stack having a thickness larger than the depth of focus of the focused radiation beam

State of the art and its disadvantages, problems:

In order to access the second, also called lower or L1, recording stack of a dual-layer DVD+R or dual-layer DVD+R+RW optical storage medium, the radiation beam must be focussed onto the recording layer of the L1 stack through three layers, i.e. the upper polycarbonate substrate, the upper L0 recordable stack and the spacer layer (see Fig. 1). Optical disturbances inside or at the interface of any of these three layers will deteriorate the optical recording signal and may even prevent reading or writing on the L1 layer.

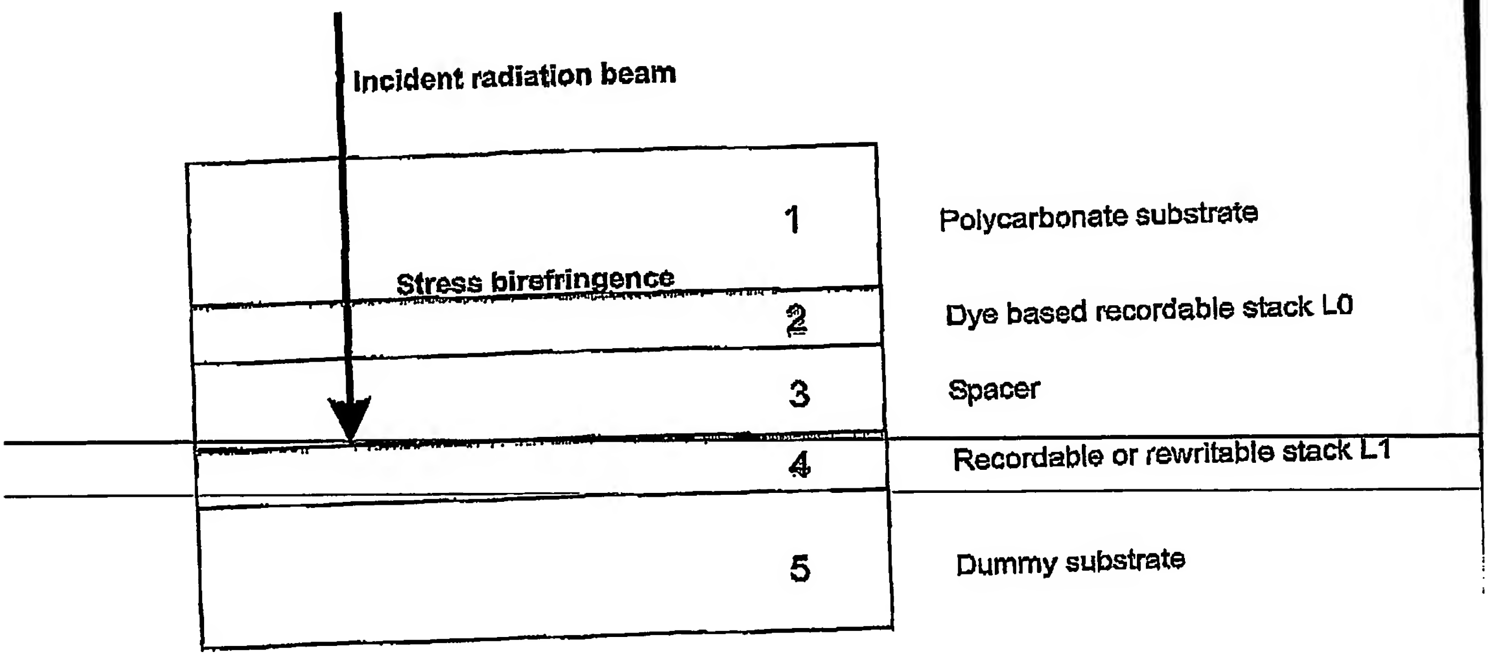


FIG. 1

In particular, if the dye material of the upper L0 stack is in direct contact with the upper polycarbonate substrate, heat absorption in the L0 dye layer during writing of the L0 may induce stress in the polycarbonate near the substrate-dye interface, thus inducing stress birefringence (also called mechanical birefringence or photoelasticity) in the upper substrate, which is the first plastic or resinous layer. The induced birefringence in the upper polycarbonate substrate may prevent to obtain a sufficiently small focussed laser spot on the lower L1 layer, and will also adversely affect the reflected laser beam from the L1 layer.

Single-layer DVD+R media, and similarly CD-R media, are much less affected by the problem discussed above, since the induced stress birefringence in the polycarbonate at the substrate-dye interface is near the laser focal point, in contrast to a dual-layer medium, in which the laser beam is well out of focus at the affected polycarbonate area (with stress birefringence) while focussing on the L1 layer.

It is an object of the invention to provide an optical data storage medium of the type mentioned in the opening paragraph which does not or hardly suffer from radiation beam induced stress birefringence in the first plastic/resinous layer by the radiation beam.

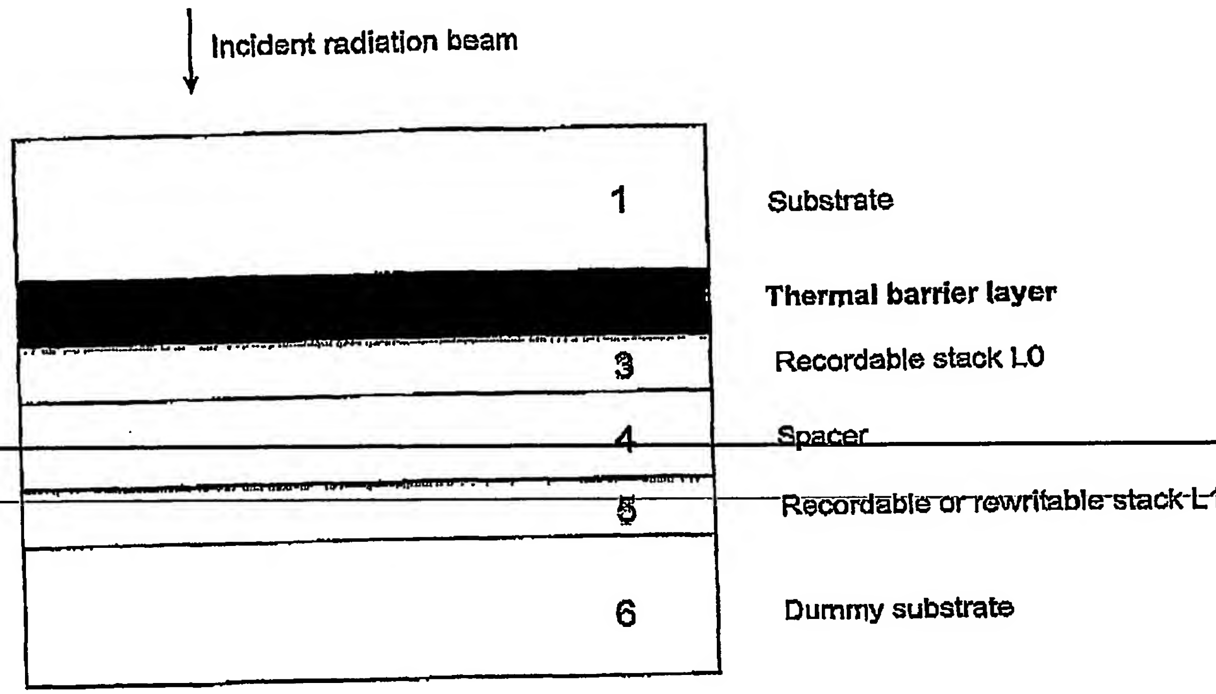
This object is achieved by an optical storage medium as described in the opening paragraph which is characterized in that an optically transparent thermal barrier layer is interposed between the first recording stack and the first plastic/resinous layer.

A thermal barrier layer between the dye material of the upper L0 recordable stack and the first plastic/resinous layer, e.g. the upper polycarbonate substrate, is proposed for use in a single-sided and double-sided dual-layer DVD+R and DVD+R+RW optical storage medium. The thermal barrier layer will eliminate stress birefringence in the upper polycarbonate substrate upon writing in the upper L0 layer, thus allowing optimum optical access to the lower L1 layer. The thermal barrier layer should be made of a material with a low thermal conductivity, preferably smaller than 1 W/mK. The material should be optically transparent for the radiation beam, i.e. the optical absorption parameter k should be zero or close to zero, e.g. << 0.01, at the wavelength of the radiation beam. The material should have a low mechanical stress and be sufficiently thick, preferably in the range of 1 - 500 nm, to reduce the temperature at the barrier-substrate interface in order to prevent mechanical distortion of the polycarbonate material. Candidate materials for the thermal barrier layer are $ZnS\text{-}SiO_2$, silicon oxynitride and silicon oxide.

The thermal barrier layer may also help to increase the recording sensitivity of the upper L0 stack. Since the L0 stack has a high [illegible], which is necessary to enable a sufficient part of the radiation beam to reach [illegible] stack, the energy of the radiation beam should be efficiently used while recording on L0. The thermal barrier layer will diminish the leaking of heat to the upper plastic/resinous substrate, thus making the L0 recordable stack more sensitive.

Embodiment

Embodiments of this invention disclosure are shown in Figs. 2 and 3.



Single-sided dual-layer DVD+R or DVD+R+RW

FIG. 2

Substrate with servo pregroove pattern (e.g. polycarbonate), thickness = 550 - 640 μm

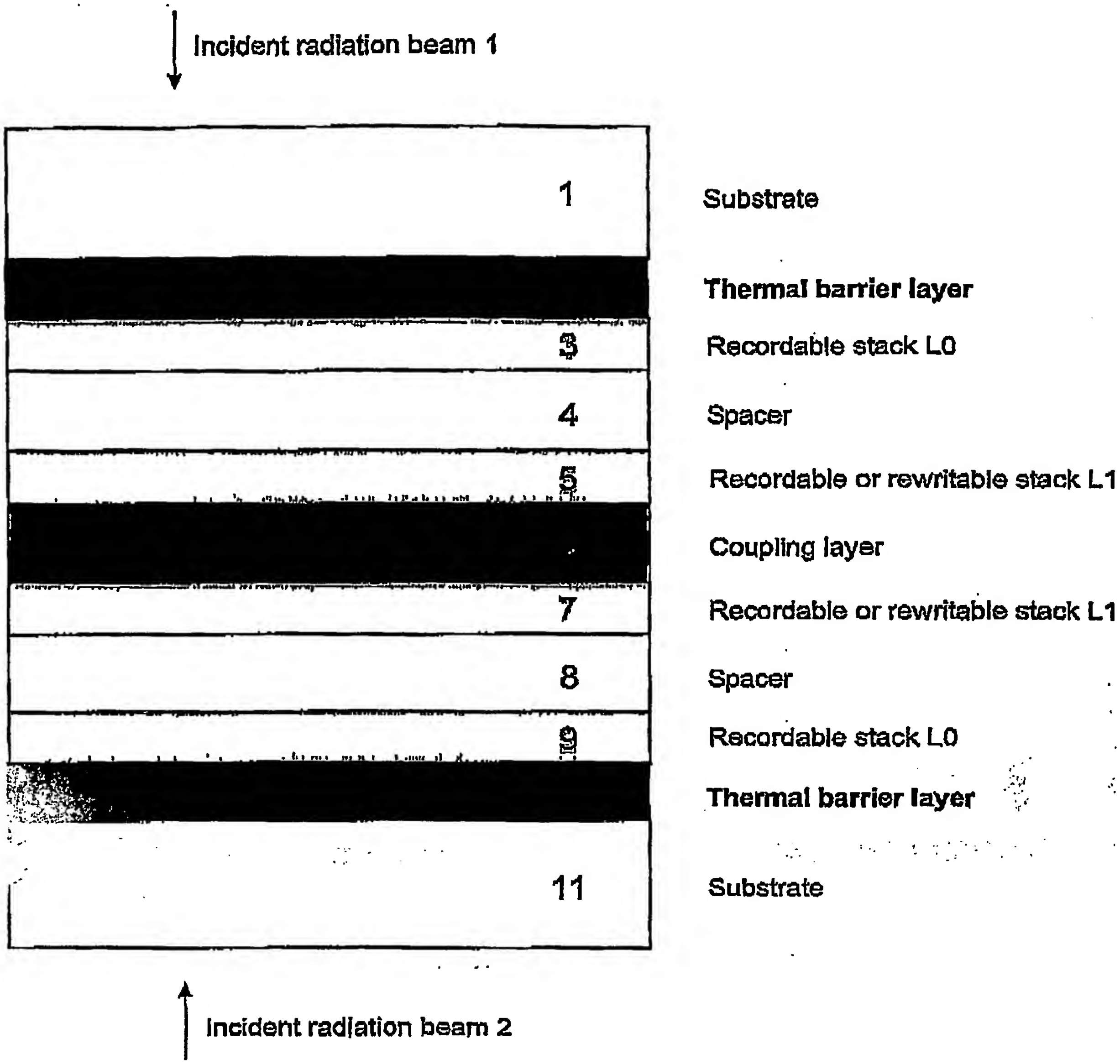
Thermal barrier layer (e.g. ZnS-SiO_2, silicon oxynitride or silicon oxide), thickness = 1 - 500 nm

Recordable stack L0 (e.g. similar to L0 stack as described in non-prepublished European Patent Application no. 02075226.7 filed by the present applicant)

Spacer layer (e.g. pressure-sensitive adhesive), thickness = 40 - 70 μm

Recordable stack L1 (e.g. similar to L1 stack as described in non-prepublished European Patent Application no. 02075226.7 filed by the present applicant) or rewritable stack L1 e.g.: similar to L1 stack as described below)

Dummy substrate with servo pregroove pattern (e.g. polycarbonate), thickness = 550 - 910 μm



Double-sided dual-layer DVD+R or DVD+R+RW

FIG. 3

Substrate with servo pregroove pattern (e.g. polycarbonate), thickness = 550 - 640 μm

Thermal barrier layer (e.g. ZnS-SiO_2, silicon oxynitride or silicon oxide), thickness = 1 - 500 nm

Recordable stack L0 (e.g. similar to L0 stack as described in non-prepublished European Patent Application no. 02075226.7 filed by the present applicant)

Spacer layer with servo pregroove (e.g. pressure-sensitive adhesive with a sheet of plastic), thickness = 40 - 70 μm

Recordable stack L1 (e.g. similar to L1 stack as described in non-prepublished European Patent Application no. 02075226.7 filed by the present applicant) or rewritable stack L1 (e.g. similar to L1 stack as described below)

Coupling layer (e.g. pressure-sensitve adhesive), thickness = 20 - 320 μm. The pregroove (or guide groove) of the L1 stacks may also be present in the coupling layer in which case the coupling layer may constitute a sheet of plastic with pregrooves on both sides. ~~In this case, spacer 4 and 8 may constitute a pressure-sensitive adhesive (PSA) without~~ pregroove.

Recordable stack L1 (e.g. similar to L1 stack as described in non-prepublished European Patent Application no. 02075226.7 filed by the present applicant) or rewritable stack L1 (e.g. similar to L1 stack as described below)

Spacer layer with servo pregroove (e.g. pressure-sensitive adhesive with a sheet of plastic), thickness = 40 - 70 μm

Recordable stack L0 (e.g. similar to L0 stack as described in non-prepublished European Patent Application no. 02075226.7 filed by the present applicant)

Thermal barrier layer (e.g. ZnS-SiO_2, silicon oxynitride or silicon oxide), thickness = 1 - 500 nm

Substrate with servo pregroove pattern (e.g. polycarbonate), thickness = 550 - 640 μm

Example of Rewritable stack L1:

Top (incoming radiation beam) to bottom (reflective layer):

a) Material: ZnS/SiO_2 (80 : 20) (n = 2.15)
Thickness: 135 nm
Deposited by sputtering

b) Material: GeInSbTe alloy (crystalline: n = 2.9; k = 4.8)
Thickness: 12 nm
Deposited by sputtering

c) Material: ZnS/SiO_2 (80 : 20) (n = 2.15)
Thickness: 23 nm
Deposited by sputtering

d) Material: Al (n = 1.97; k = 7.83)

Thickness: 100 nm

Deposited by sputtering

CLAIM:

1. An optical data storage medium for recording by means of a focused radiation beam entering the medium through a first plastic/resinous layer transparent for the radiation beam, said medium further comprising at least:

- a first recording stack, comprising a first recording layer, being present proximate the first plastic/resinous layer,
- a second recording stack, comprising a second recording layer, said second recording stack being present at a position more remote from the first plastic/resinous layer than the first recording stack,
- a transparent spacer layer between the first and the second recording stack having a thickness larger than the depth of focus of the focused radiation beam

characterized in that an optically transparent thermal barrier layer is interposed between the first recording stack and the first plastic/resinous layer.

ABSTRACT:

An optical data storage medium for recording by means of a focused radiation beam is described. The beam enters the medium through a first plastic/resinous layer transparent for the radiation beam. The medium has at least a first recording stack, which is present proximate the first plastic/resinous layer and a second recording stack, which is present at a position more remote from the first plastic/resinous layer than the first recording stack. A transparent spacer layer is present between the first and the second recording stack with a thickness larger than the depth of focus of the focused radiation beam. In order to prevent thermally induced birefringence in the first plastic/resinous layer a thermal barrier layer is interposed between the first recording stack and the first plastic/resinous layer. In such a way a better optical quality of the radiation beam in the second recording stack is possible. This improves writing and reading of information in the second recording stack.

Fig. 2